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Magic-number nanocrystals by chemical methods and their potential applications

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The high-end nanotechnology that essentially depends on excellent nano-chemistry, has prompted chemists to undertake new challenges, not only in synthesis but in tailoring desired optical properties for useful applications in electronics and optical devices. In recent years, Quantum dots have greatly influenced the fate of photonic devices and of late, their potential as sensitizers for replacing organic dyes in dye-sensitized solar cells and their conjugation with bio-molecules for bio-solar cells has attracted many researchers. Enhanced experimental skills of chemists are now playing major role in isolation of thermodynamically stable pre-mature 'early-stage' elongated nano-particles which upon isolation are termed as 'Magic-number nano-crystals'. Because of their not-so-perfect crystal structure these magic-number NCs differ with QDs in their optical properties e.g. a doublet absorption and broad emission wavelength in compare to single narrow absorption and emission of QDs. The optical properties can be tuned either for magic-size NCs alone or a combination of with QDs and or can be converted to ofthat of pure QDs in case of CdSe. These high-end nano-crystals thus become potential candidate for white LEDs. QDs synthesis via organometallic reactions are often preferred but warrants special efforts. Alkeno-1,2,3-selenadiazoles are excellent Se-provider reasonably greener synthesis of magic-sized NCs as well as of regular metal selenides that includes CdSe. The high-end products/particles can be isolated with ease directly or via formation of molecular cluster of [Cd(C12H18Se2Br2)]. This lecture will deal with the chemical aspects of high quality nano-crystals.

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Studies of Complex Materials with Hot Neutrons

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Studies of high-energy atomic, molecular and magnetic dynamics in condensed matter are being performed at ILL on the hot-neutron spectrometer called IN1. This instrument comprises two different secondary spectrometer options which can be alternatively connected to the unique single crystal monochromator with three reflecting faces supplying monochromatic neutron beams in the broad energy range (10 - 1000 meV). Flexibility in the choice of the experimental conditions combined with convenience of the changes permit a wide range for the optimisation on resolution/intensity. The classical-scheme three-axis spectrometer IN1-TAS is used for measurements of dispersion curves of elementary excitations in single crystals and liquid or amorphous samples. This secondary spectrometer is now equipped with a new double-focussing copper crystal analyser. The new secondary spectrometer IN1-LAGRANGE (LArge GRaphite ANalyser for Genuine Excitations) commissioned few months ago opens new perspectives for studies of phonon density of states on polycrystalline samples. Particular emphasis is given to a possibility of high-resolution measurements of extremely small samples (containing down to 0.1 mg of Hydrogen). Examples are given of the experiments performed on both spectrometers which include magnetic moment dynamics in magnets, atomic dynamics in liquids with the high-resolution Brillouin scattering setup, proton dynamics in complex molecular compounds.

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